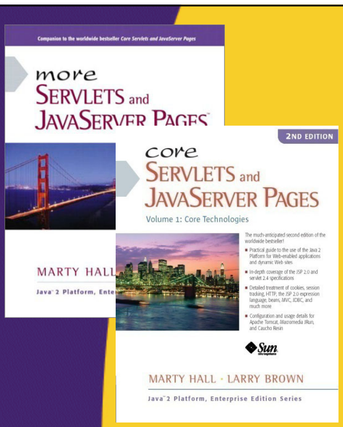
Simplifying Access to Java Code: The JSP 2 Expression Language

Originals of Slides and Source Code for Examples:
http://courses.coreservlets.com/Course-Materials/csajsp2.html



Agenda

- Motivating use of the expression language
- Understanding the basic syntax
- Understanding the relationship of the expression language to the MVC architecture
- Referencing scoped variables
- Accessing bean properties, array elements, List elements, and Map entries
- Using expression language operators
- Evaluating expressions conditionally

EL Motivation: Simplifying MVC Output Pages

Servlets and JSP: Possibilities for Handling a Single Request

- **Servlet only. Works well when:**
  - Output is a binary type. E.g.: an image
  - There is *no* output. E.g.: you are doing forwarding or redirection as in Search Engine example.
  - Format/layout of page is highly variable. E.g.: portal.
- **JSP only. Works well when:**
  - Output is mostly character data. E.g.: HTML
  - Format/layout mostly fixed.
- **Combination (MVC architecture). Needed when:**
  - A single request will result in multiple substantially different-looking results.
  - You have a large development team with different team members doing the Web development and the business logic.
  - You perform complicated data processing, but have a relatively fixed layout.

Implementing MVC with RequestDispatcher

1. **Define beans to represent result data**
   - Ordinary Java classes with at least one get*Blah* method
2. **Use a servlet to handle requests**
   - Servlet reads request parameters, checks for missing and malformed data, calls business logic, etc.
3. **Obtain bean instances**
   - The servlet invokes business logic (application-specific code) or data-access code to obtain the results.
4. **Store the bean in the request, session, or servlet context**
   - The servlet calls setAttribute on the request, session, or servlet context objects to store a reference to the beans that represent the results of the request.

Implementing MVC with RequestDispatcher (Continued)

5. **Forward the request to a JSP page.**
   - The servlet determines which JSP page is appropriate to the situation and uses the forward method of RequestDispatcher to transfer control to that page.
6. **Extract the data from the beans.**
   - The JSP page accesses beans with jsp:useBean and a scope matching the location of step 4. The page then uses jsp:getProperty to output the bean properties.
   - The JSP page does not create or modify the bean; it merely extracts and displays data that the servlet created.

Drawback of MVC

- **Main drawback is the final step: presenting the results in the JSP page.**
  - jsp:useBean and jsp:getProperty
    - Clumsy and verbose
    - Cannot access bean subproperties
  - JSP scripting elements
    - Result in hard-to-maintain code
    - Defeat the whole purpose behind MVC.
- **Goal**
  - More concise, succinct, and readable syntax
    - Accessible to Web developers
  - Ability to access subproperties
  - Ability to access collections

Main Point of EL for New MVC Apps

- **Bean**
  - public String getFirstName(…) { … }
- **Servlet**
  - Customer someCust = lookupService.findCustomer(…);
  - request.setAttribute("customer", someCust);
  - (Use RequestDispatcher.forward to go to JSP page)
- **JSP**
  - <h1>First name is ${customer.firstName}</h1>

  - If this is all you ever know about the Expression Language, you are still in pretty good shape

Main Point of EL for MVC Apps that are Upgrading from JSP 1.2

- **When in JSP 2.x-compliant server with current web.xml version, change:**

```
<jsp:useBean id="someName"
             type="somePackage.someClass"
             scope="request, session, or application"/>
<jsp:getProperty name="someName"
                 property="someProperty"/>
```

- **To:**

```
${someName.someProperty}
```

- **Bean, servlet, business logic**
  - Remain exactly the same as before

Advantages of the Expression Language

- **Concise access to stored objects.**
  - To output a "scoped variable" (object stored with setAttribute in the PageContext, HttpServletRequest, HttpSession, or ServletContext) named saleItem, you use ${saleItem}.
- **Shorthand notation for bean properties.**
  - To output the companyName property (i.e., result of the getCompanyName method) of a scoped variable named company, you use ${company.companyName}. To access the firstName property of the president property of a scoped variable named company, you use ${company.president.firstName}.
- **Simple access to collection elements.**
  - To access an element of an array, List, or Map, you use ${variable[indexOrKey]}. Provided that the index or key is in a form that is legal for Java variable names, the dot notation for beans is interchangeable with the bracket notation for collections.

Advantages of the Expression Language (Continued)

- **Succinct access to request parameters, cookies, and other request data.**
  - To access the standard types of request data, you can use one of several predefined implicit objects.
- **A small but useful set of simple operators.**
  - To manipulate objects within EL expressions, you can use any of several arithmetic, relational, logical, or empty-testing operators.
- **Conditional output.**
  - To choose among output options, you do not have to resort to Java scripting elements. Instead, you can use ${test ? option1 : option2}.
- **Automatic type conversion.**
  - The expression language removes the need for most typecasts and for much of the code that parses strings as numbers.
- **Empty values instead of error messages.**
  - In most cases, missing values or NullPointerExceptions result in empty strings, not thrown exceptions.

Setup

Activating the Expression Language

- **Available only in servers that support JSP 2.0 or 2.1 (servlets 2.4 or 2.5)**
  - E.g., Tomcat 5 or later, WebLogic 9 or later, WS 6+,
    - Not Tomcat 4 or WebLogic 8 or WebSphere 5
  - For a full list of compliant servers, see http://theserverside.com/reviews/matrix.tss
- **You must use the JSP 2.x web.xml file**
  - Download from coreservlets.com, use one from Tomcat 5 or 6, or Eclipse/MyEclipse will build one for you

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation=
           "http://java.sun.com/xml/ns/j2ee web-app_2_4.xsd"
         version="2.4">
  …
</web-app>
```

Invoking the Expression Language

- **Basic form: ${expression}**
  - These EL elements can appear in ordinary text or in JSP tag attributes, provided that those attributes permit regular JSP expressions. For example:
    - <ul>
    -   <li>Name: ${expression1}</li>
    -   <li>Address: ${expression2}</li>
    - </ul>
    - <jsp:include page="${expression3}"/>
- **The EL in tag attributes**
  - You can use multiple expressions (possibly intermixed with static text) and the results are coerced to strings and concatenated. For example:
    - <jsp:include page="${expr1}blah${expr2}"/>

Rare (but Confusing) EL Problem

- **Scenario**
  - You use ${something} in a JSP page
  - You literally get "${something}" in the output
  - You realize you forgot to update an old web.xml file to refer to servlets 2.4 (or 2.5), so you do so
  - You redeploy your Web app and restart the server
  - You *still* literally get "${something}" in the output
- **Why?**
  - The JSP page was already translated into a servlet
    - A servlet that ignored the expression language
- **Solution**
  - Resave the JSP page to update its modification date

Preventing Expression Language Evaluation

- **What if JSP page contains ${ ?**
  - Perhaps by accident, perhaps if you make a custom tag library that also uses ${...} notation and evaluates it directly (as with first release of JSTL).
- **Deactivating the EL in an entire Web application.**
  - Use a web.xml file that refers to servlets 2.3 (JSP 1.2) or earlier.
- **Deactivating the expression language in multiple JSP pages.**
  - Use the jsp-property-group web.xml element
- **Deactivating the expression language in individual JSP pages.**
  - Use <%@ page isELIgnored="true" %>
- **Deactivating individual EL statements.**
  - In JSP 1.2 pages that need to be ported unmodified across multiple JSP versions (with no web.xml changes), you can replace $ with &#36;, the HTML character entity for $.
  - In JSP 2.0 pages that contain both EL statements and literal ${ strings, you can use \${ when you want ${ in the output

Preventing Use of Standard Scripting Elements

- **To enforce EL-only with no scripting, use scripting-invalid in web.xml**

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<web-app xmlns="http://java.sun.com/xml/ns/j2ee"
         xmlns:xsi=
           "http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation=
           "http://java.sun.com/xml/ns/j2ee web-app_2_4.xsd"
         version="2.4">
  <jsp-property-group>
    <url-pattern>*.jsp</url-pattern>
    <scripting-invalid>true</scripting-invalid>
  </jsp-property-group>
</web-app>
```

Downsides to Preventing Use of Scripting Elements

- **Harder debugging**
  - <% System.out.println("...."); %>
- **No redirects**
  - <% response.sendRedirect("welcome.jsf"); %>
- **Some techniques hard to do with MVC**

  -
    ```
    <%
    if (outputShouldBeExcel()) {
      response.setContentType("application/vnd.ms-excel");
    }
    %>
    ```
- **Just because scripting is *usually* bad does not mean it is *always* bad**

EL Uses: Scoped vars, Bean properties, collections

Accessing Scoped Variables

- **${varName}**
  – Searches the PageContext, the HttpServletRequest, the HttpSession, and the ServletContext, *in that order*, and output the object with that attribute name. PageContext does not apply with MVC.
  – Application: if you just have an error message, you can store the String directly instead of putting it in a bean and storing the bean
- **Equivalent forms**
  – ${name}
  – <%= pageContext.findAttribute("name") %>
  – <jsp:useBean id="name"
                      type="somePackage.SomeClass"
                      scope="...">
    <%= name %>

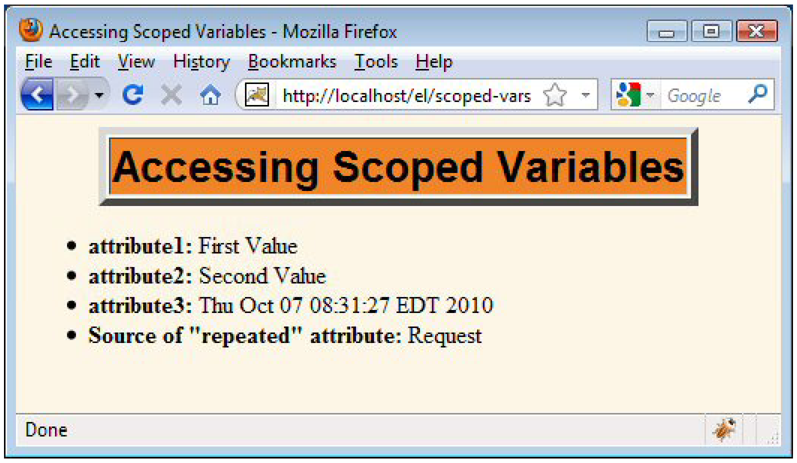
Example: Accessing Scoped Variables

```
@WebServlet("/scoped-vars")
public class ScopedVars extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    request.setAttribute("attribute1", "First Value");
    HttpSession session = request.getSession();
    session.setAttribute("attribute2", "Second Value");
    ServletContext application = getServletContext();
    application.setAttribute("attribute3",
                             new java.util.Date());
    request.setAttribute("repeated", "Request");
    session.setAttribute("repeated", "Session");
    application.setAttribute("repeated", "ServletContext");
    RequestDispatcher dispatcher =
      request.getRequestDispatcher
               ("/WEB-INF/results/scoped-vars.jsp");
    dispatcher.forward(request, response);
  }
}
```

Example: Accessing Scoped Variables (Continued)

```
<!DOCTYPE …>
…
<TABLE BORDER=5 ALIGN="CENTER">
  <TR><TH CLASS="TITLE">
  Accessing Scoped Variables
</TABLE>
<P>
<UL>
  <LI><B>attribute1:</B> ${attribute1}
  <LI><B>attribute2:</B> ${attribute2}
  <LI><B>attribute3:</B> ${attribute3}
  <LI><B>Source of "repeated" attribute:</B>
      ${repeated}
</UL>
</BODY></HTML>
```

Example: Accessing Scoped Variables (Result)


Accessing Scoped Variables - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/el/scoped-vars
Google
Done

Accessing Scoped Variables

- **attribute1:** First Value
- **attribute2:** Second Value
- **attribute3:** Thu Oct 07 08:31:27 EDT 2010
- **Source of "repeated" attribute:** Request

Accessing Bean Properties

- **${varName.propertyName}**
  - Means to find scoped variable of given name and output the specified bean property
    - Remember from MVC lecture that bean property corresponds to getter method name, not instance var.
- **Equivalent forms**
  - ${customer.firstName}

  -
    ```
    <%@ page import="coreservlets.NameBean" %>
    <%
    NameBean person =
        (NameBean)pageContext.findAttribute("customer");
    %>
    <%= person.getFirstName() %>
    ```

Accessing Bean Properties (Continued)

- **Equivalent forms**
  - ${customer.firstName}

  -
    ```
    <jsp:useBean id="customer"
                      type="coreservlets.NameBean"
                      scope="request, session, or application" />
    <jsp:getProperty name="customer"
                         property="firstName" />
    ```
- **This is better than script on previous slide.**
  - But, requires you to know the scope
  - And fails for subproperties.
    - No non-Java equivalent to ${customer.address.zipCode}

Example: Accessing Bean Properties

```
@WebServlet("/bean-properties")
public class BeanProperties extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    Name name = new Name("Marty", "Hall");
    Company company =
      new Company("coreservlets.com",
                  "Customized Java EE and Ajax Training");
    Employee employee =
      new Employee(name, company);
    request.setAttribute("employee", employee);
    RequestDispatcher dispatcher =
      request.getRequestDispatcher
        ("/WEB-INF/results/bean-properties.jsp");
    dispatcher.forward(request, response);
  }
}
```

Example: Accessing Bean Properties (Continued)

```
public class Employee {
  private Name name;
  private Company company;

  public Employee(Name name, Company company) {
    setName(name);
    setCompany(company);
  }

  public Name getName() { return(name); }

  public void setName(Name name) {
    this.name = name;
  }

  public CompanyBean getCompany() { return(company); }

  public void setCompany(Company company) {
    this.company = company;
  }
}
```

Example: Accessing Bean Properties (Continued)

```
public class Name {
  private String firstName;
  private String lastName;

  public Name(String firstName, String lastName) {
    setFirstName(firstName);
    setLastName(lastName);
  }

  public String getFirstName() {
    return (firstName);
  }
  public void setFirstName(String firstName) {
    this.firstName = firstName;
  }
  public String getLastName() {
    return (lastName);
  }
  public void setLastName(String lastName) {
    this.lastName = lastName;
  }
}
```

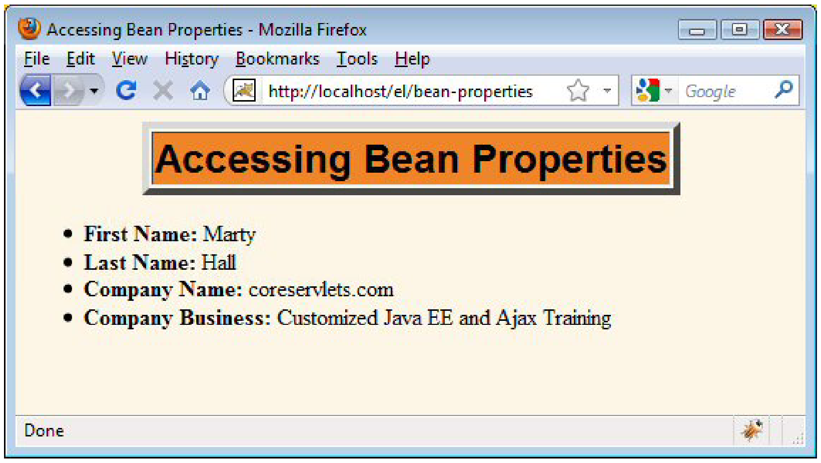
Example: Accessing Bean Properties (Continued)

```
public class Company {
  private String companyName;
  private String business;

  public Company(String companyName, String business) {
    setCompanyName(companyName);
    setBusiness(business);
  }

  public String getCompanyName() { return(companyName); }

  public void setCompanyName(String companyName) {
    this.companyName = companyName;
  }

  public String getBusiness() { return(business); }

  public void setBusiness(String business) {
    this.business = business;
  }
}
```

Example: Accessing Bean Properties (Continued)

```
<!DOCTYPE …>
…
<UL>
  <LI><B>First Name:</B>
      ${employee.name.firstName}
  <LI><B>Last Name:</B>
      ${employee.name.lastName}
  <LI><B>Company Name:</B>
      ${employee.company.companyName}
  <LI><B>Company Business:</B>
      ${employee.company.business}
</UL>
</BODY></HTML>
```

Example: Accessing Bean Properties (Result)


Accessing Bean Properties - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/el/bean-properties
Google
Done

Accessing Bean Properties

- **First Name:** Marty
- **Last Name:** Hall
- **Company Name:** coreservlets.com
- **Company Business:** Customized Java EE and Ajax Training

Equivalence of Dot and Array Notations

- **Equivalent forms**
  - ${name.property}
  - ${name["property"]}
- **Reasons for using array notation**
  - To access arrays, lists, and other collections
    - See upcoming slides
  - To calculate the property name at request time.
    - {name1[name2]}   (no quotes around name2)
  - To use names that are illegal as Java variable names
    - {foo["bar-baz"]}
    - {foo["bar.baz"]}

Accessing Collections

- **${attributeName[entryName]}**
- **Works for**
  - Array. Equivalent to
    - theArray[index]
  - List. Equivalent to
    - theList.get(index)
  - Map. Equivalent to
    - theMap.get(keyName)
- **Equivalent forms (for HashMap)**
  - ${stateCapitals["maryland"]}
  - ${stateCapitals.maryland}
  - But the following is illegal since 2 is not a legal var name
    - ${listVar.2}

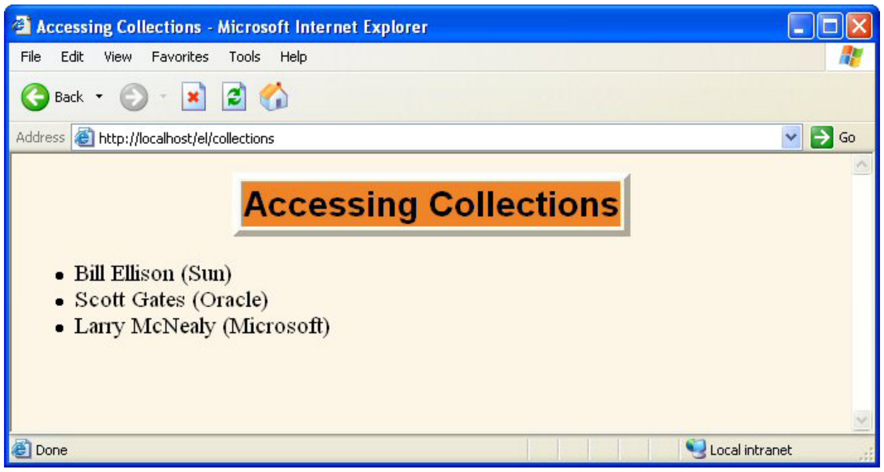
Example: Accessing Collections

```
public class Collections extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    String[] firstNames = { "Bill", "Scott", "Larry" };
    List<String> lastNames = new ArrayList<String>();
    lastNames.add("Ellison");
    lastNames.add("Gates");
    lastNames.add("McNealy");
    Map<String,String> companyNames =
      new HashMap<String,String>();
    companyNames.put("Ellison", "Sun");
    companyNames.put("Gates", "Oracle");
    companyNames.put("McNealy", "Microsoft");
    request.setAttribute("first", firstNames);
    request.setAttribute("last", lastNames);
    request.setAttribute("company", companyNames);
    RequestDispatcher dispatcher =
      request.getRequestDispatcher
                  ("/WEB-INF/results/collections.jsp");
    dispatcher.forward(request, response);
  }
```

Example: Accessing Collections (Continued)

```
<!DOCTYPE …>
…
<BODY>
<TABLE BORDER=5 ALIGN="CENTER">
  <TR><TH CLASS="TITLE">
  Accessing Collections
</TABLE>
<P>
<UL>
  <LI>${first[0]} ${last[0]} (${company["Ellison"]})
  <LI>${first[1]} ${last[1]} (${company["Gates"]})
  <LI>${first[2]} ${last[2]} (${company["McNealy"]})
</UL>
</BODY></HTML>
```

Example: Accessing Collections (Result)


Accessing Collections - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Address http://localhost/el/collections
Go
Done
Local intranet

Accessing Collections

- Bill Ellison (Sun)
- Scott Gates (Oracle)
- Larry McNealy (Microsoft)

Implicit Objects and Operators

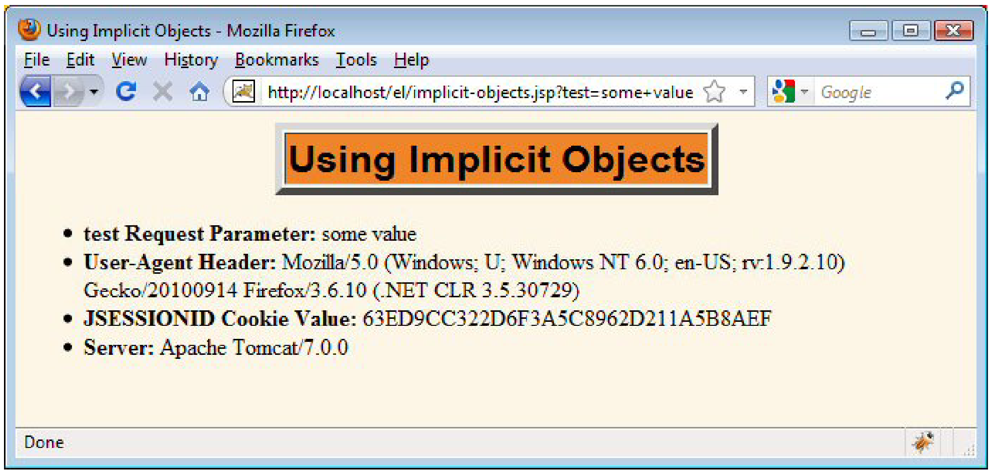
Referencing Implicit Objects (Predefined Variable Names)

- **pageContext. The PageContext object.**
  - E.g. ${pageContext.session.id}
- **param and paramValues. Request params.**
  - E.g. ${param.custID}
- **header and headerValues. Request headers.**
  - E.g. ${header.Accept} or ${header["Accept"]}
  - ${header["Accept-Encoding"]}
- **cookie. Cookie object (not cookie value).**
  - E.g. ${cookie.userCookie.value} or ${cookie["userCookie"].value}
- **initParam. Context initialization param.**
- **pageScope, requestScope, sessionScope, applicationScope.**
  - Instead of searching scopes.
- **Problem**
  - Using implicit objects usually works poorly with MVC model

Example: Implicit Objects

```
<!DOCTYPE …>
…
<P>
<UL>
  <LI><B>test Request Parameter:</B>
      ${param.test}
  <LI><B>User-Agent Header:</B>
      ${header["User-Agent"]}
  <LI><B>JSESSIONID Cookie Value:</B>
      ${cookie.JSESSIONID.value}
  <LI><B>Server:</B>
      ${pageContext.servletContext.serverInfo}
</UL>
</BODY></HTML>
```

Example: Implicit Objects (Result)


Using Implicit Objects - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/el/implicit-objects.jsp?test=some+value
Google
Done

Using Implicit Objects

- **test Request Parameter:** some value
- **User-Agent Header:** Mozilla/5.0 (Windows; U; Windows NT 6.0; en-US; rv:1.9.2.10) Gecko/20100914 Firefox/3.6.10 (.NET CLR 3.5.30729)
- **JSESSIONID Cookie Value:** 63ED9CC322D6F3A5C8962D211A5B8AEF
- **Server:** Apache Tomcat/7.0.0

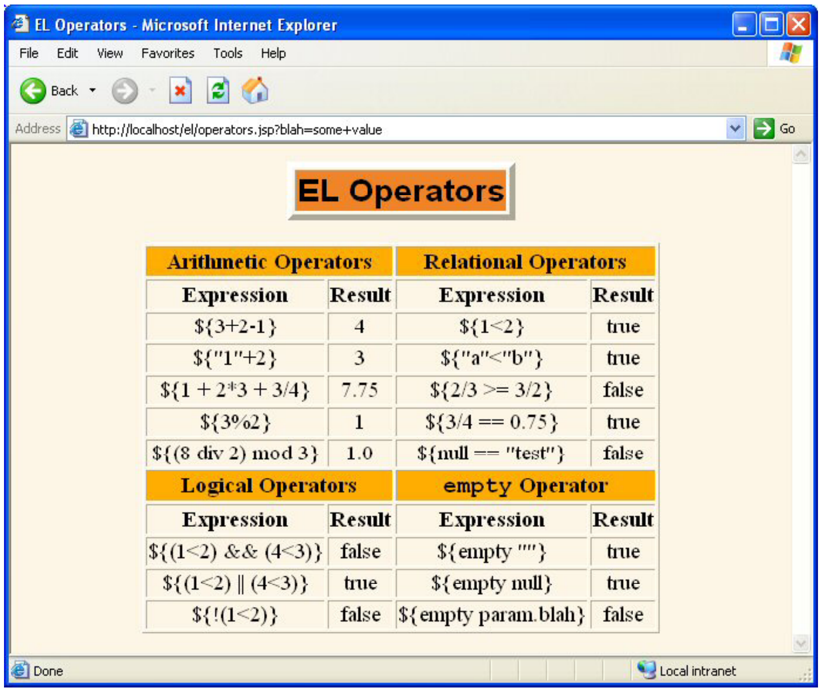
Expression Language Operators

- **Arithmetic**
  - + - * / div % mod
- **Relational**
  - == eq != ne < lt > gt <= le >= ge
- **Logical**
  - && and || or ! Not
- **Empty**
  - Empty
  - True for null, empty string, empty array, empty list, empty map. False otherwise.
- **CAUTION**
  - Use extremely sparingly to preserve MVC model

Example: Operators

```
…
<TABLE BORDER=1 ALIGN="CENTER">
  <TR><TH CLASS="COLORED" COLSPAN=2>Arithmetic Operators
      <TH CLASS="COLORED" COLSPAN=2>Relational Operators
  <TR><TH>Expression<TH>Result<TH>Expression<TH>Result
  <TR ALIGN="CENTER">
    <TD>\${3+2-1}<TD>${3+2-1}
    <TD>\${1&lt;2}<TD>${1<2}
  <TR ALIGN="CENTER">
    <TD>\${"1"+2}<TD>${"1"+2}
    <TD>\${"a"&lt;"b"}<TD>${"a"<"b"}
  <TR ALIGN="CENTER">
    <TD>\${1 + 2*3 + 3/4}<TD>${1 + 2*3 + 3/4}
    <TD>\${2/3 &gt;= 3/2}<TD>${2/3 >= 3/2}
  <TR ALIGN="CENTER">
    <TD>\${3%2}<TD>${3%2}
    <TD>\${3/4 == 0.75}<TD>${3/4 == 0.75}
…
```

Example: Operators (Result)


EL Operators - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Address http://localhost/el/operators.jsp?blah=some+value
Go
Done
Local intranet

EL Operators

Arithmetic Operators		Relational Operators	
Expression	Result	Expression	Result
${3+2-1}	4	${1<2}	true
${"1"+2}	3	${"a"<"b"}	true
${1 + 2*3 + 3/4}	7.75	${2/3 >= 3/2}	false
${3%2}	1	${3/4 == 0.75}	true
${(8 div 2) mod 3}	1.0	${null == "test"}	false
Logical Operators		**empty Operator**	
Expression	Result	Expression	Result
${(1<2) && (4<3)}	false	${empty ""}	true
${(1<2) || (4<3)}	true	${empty null}	true
${!(1<2)}	false	${empty param.blah}	false

Evaluating Expressions Conditionally

- **${ test ? expression1 : expression2 }**
  - Evaluates test and outputs either expression1 or expression2
- **Problems**
  - Relatively weak
    - c:if and c:choose from JSTL are much better
  - Tempts you to put business/processing logic in JSP page.
  - Should only be used for presentation logic.
    - Even then, consider alternatives

Example: Conditional Expressions

```
@WebServlet("/conditionals")
public class Conditionals extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    SalesBean apples =
      new SalesBean(150.25, -75.25, 22.25, -33.57);
    SalesBean oranges =
      new SalesBean(-220.25, -49.57, 138.25, 12.25);
    request.setAttribute("apples", apples);
    request.setAttribute("oranges", oranges);
    RequestDispatcher dispatcher =
      request.getRequestDispatcher
        ("/WEB-INF/results/conditionals.jsp");
    dispatcher.forward(request, response);
  }
}
```

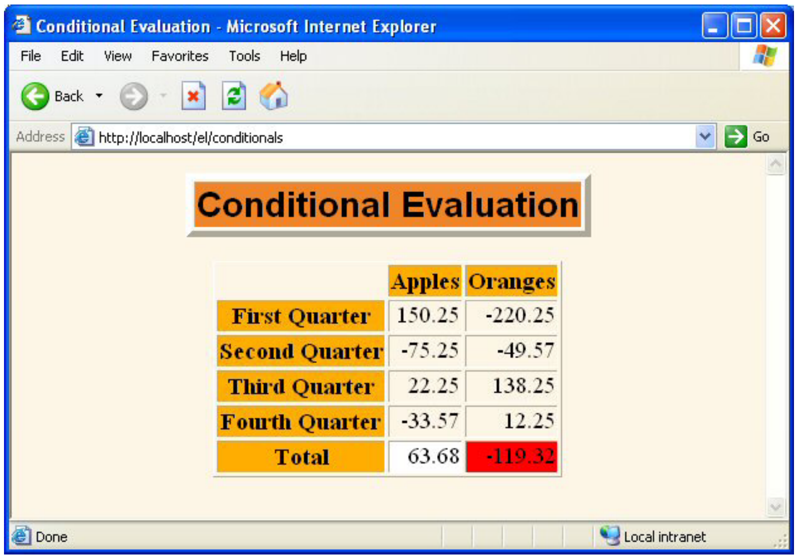
Example: Conditional Expressions (Continued)

```
public class SalesBean {
  private double q1, q2, q3, q4;

  public SalesBean(double q1Sales,
                   double q2Sales,
                   double q3Sales,
                   double q4Sales) {
    q1 = q1Sales; q2 = q2Sales;
    q3 = q3Sales; q4 = q4Sales;
  }

  public double getQ1() { return(q1); }
  public double getQ2() { return(q2); }
  public double getQ3() { return(q3); }
  public double getQ4() { return(q4); }
  public double getTotal() {
    return(q1 + q2 + q3 + q4); }
}
```

Example: Conditional Expressions (Continued)

```
…
<TABLE BORDER=1 ALIGN="CENTER">
  <TR><TH>
      <TH CLASS="COLORED">Apples
      <TH CLASS="COLORED">Oranges
  <TR><TH CLASS="COLORED">First Quarter
      <TD ALIGN="RIGHT">${apples.q1}
      <TD ALIGN="RIGHT">${oranges.q1}
  <TR><TH CLASS="COLORED">Second Quarter
      <TD ALIGN="RIGHT">${apples.q2}
      <TD ALIGN="RIGHT">${oranges.q2}
…
  <TR><TH CLASS="COLORED">Total
      <TD ALIGN="RIGHT"
          BGCOLOR="${(apples.total < 0) ? "RED" : "WHITE" }">
      ${apples.total}
      <TD ALIGN="RIGHT"
          BGCOLOR="${(oranges.total < 0) ? "RED" : "WHITE" }">
      ${oranges.total}
</TABLE>…
```

Example: Conditional Expressions (Result)



Conditional Evaluation - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Address http://localhost/el/conditionals
Go
Done
Local intranet

Conditional Evaluation

	Apples	Oranges
First Quarter	150.25	-220.25
Second Quarter	-75.25	-49.57
Third Quarter	22.25	138.25
Fourth Quarter	-33.57	12.25
Total	63.68	-119.32

Redoing JSP 1.2 MVC Examples in JSP 2

Request-Based Sharing: JSP 1.2

```
…
<BODY>
<jsp:useBean id="randomNum"
             type="coreservlets.NumberBean"
             scope="request" />
<H2>Random Number:
<jsp:getProperty name="randomNum"
                 property="number" />
</H2>
</BODY></HTML>
```

Request-Based Sharing: JSP 2.x

```
…
<BODY>
<H2>Random Number:
${randomNum.number}
</H2>
</BODY></HTML>
```

Session-Based Sharing: JSP 1.2

```
…
<BODY>
<H1>Thanks for Registering</H1>
<jsp:useBean id="nameBean"
             type="coreservlets.NameBean"
             scope="session" />
<H2>First Name:
<jsp:getProperty name="nameBean"
                 property="firstName" /></H2>
<H2>Last Name:
<jsp:getProperty name="nameBean"
                 property="lastName" /></H2>
</BODY></HTML>
```

Session-Based Sharing: JSP 2.x

```
…
<BODY>
<H1>Thanks for Registering</H1>
<H2>First Name:
${nameBean.firstName}</H2>
<H2>Last Name:
${nameBean.lastName}</H2>
</BODY></HTML>
```

ServletContext-Based Sharing: JSP 1.2

```
…
<BODY>
<H1>A Prime Number</H1>
<jsp:useBean id="primeBean"
             type="coreservlets.PrimeBean"
             scope="application" />
<jsp:getProperty name="primeBean"
                 property="prime" />
</BODY></HTML>
```

ServletContext-Based Sharing: JSP 2.x

```
…
<BODY>
<H1>A Prime Number</H1>
${primeBean.prime}
</BODY></HTML>
```

Wrap-Up

Summary

- **The JSP 2 EL provides concise, easy-to-read access to**
  - Scoped variables
  - Bean properties
  - Collection elements
  - Standard HTTP elements such as request parameters, request headers, and cookies
- **The JSP 2 EL works best with MVC**
  - Use only to output values created by separate Java code
- **Resist use of EL for business logic**
  - Use EL operators and conditionals sparingly, if at all

Questions?